Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules Regarding Dedicated Short-Range Communication Services in the 5.850-5.925 GHz Band (5.9 GHz Band)	)	WT Docket No. 01-90
	)	
Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services	)	ET Docket No. 98-95 RM-9096

REPORT AND ORDER

Adopted: December 17, 2003 **Released: February 10, 2004**

By the Commission: Chairman Powell and Commissioner Adelstein issuing separate statements.

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I. INTRODUCTION

1. In this proceeding, we are adopting licensing and service rules for the Dedicated Short Range Communications Service (DSRCS) in the Intelligent Transportation Systems (ITS) Radio Service in the 5.850-5.925 GHz band (5.9 GHz band). We believe that the rules we adopt today further the important Commission goal of striking a sound balance between "flexible" rules that more easily facilitate the development and offering of new and innovative services and the "command and control" approach that is often regarded as necessary for effective public safety communications. We also believe that this approach is particularly appropriate in the context of the transportation industry, which involves protecting the safety of the traveling public.

2. DSRC provides the critical communications link for intelligent transportation systems,[1] which according to the Secretary of Transportation, are the key to achieving the United States Department of Transportation's (DOT) number one priority, reducing highway fatalities.[2] Each year, hazards or driver error lead to more than six million crashes that—

- cause nearly 43,000 deaths and 3 million injuries;
- cost "more than $230 billion dollars; and
- consume a greater share of the Nation's health care costs than any other cause of illness injury."[3]

3. Time is critical in crash avoidance—at 70 miles per hour, a vehicle travels more than 100 feet every second.[4] Dedicated short-range communications (DSRC), which involves vehicle-to-vehicle and vehicle-to-infrastructure communications, can save lives by warning drivers of an impending dangerous condition or event in time to take corrective or evasive actions. For example, one life-saving ITS application made possible by DSRC is intersection collision avoidance (*e.g.*, audible alarm: "Intersection ahead with red light – STOP."). The intersection collision avoidance application will use roadside speed and location sensing equipment, DSRC equipment, in-vehicle signing and trajectory computing and control electronics to help drivers avoid intersection collisions, the most prevalent type of traffic accident in the U.S. Intersection collision avoidance functions through the application of the "three Ps" – perceive, process, and present. First, sensors perceive the location, trajectory and speed of other vehicles. Next, processors calculate the likelihood of a collision and avoidance actions. Finally, information is presented to the driver in one of three forms: information on threats; instructions regarding evasive actions; or a partial system take-over of control of the vehicle. For example, a driver can be alerted when a high speed vehicle is approaching as she waits to cross a roadway. In addition, drivers can receive warning of an approaching vehicle about to run a red light or of the speed of on-coming vehicles

[1] Jeffrey N. Shane, Under Secretary for Transportation, DOT, Address at the Intelligent Vehicle Initiative National Meeting and Demonstration (June 25, 2003) (http://www.dot.gov/affairs/shane06252003.htm).

[2] Press Release, U.S. Transportation Secretary Mineta Announces Opening of Crash-Preventing "Intelligent Intersection" Test Facility (June 24, 2003) (http://www.its.dot.gov/press/fhw2003.htm).

[3] U.S. DOT (http://www.its.dot.gov/ivi/mission.html). Over ninety percent of crashes result from driver error. *Id.* *See also* Intelligent Safety Efforts in America, Jeffrey F. Paniati, Director, Intelligent Transportation Systems, U.S. Department of Transportation (presentation at 10th ITS World Congress, Madrid, Spain, on Nov. 17, 2003) (http://www.its.dot.gov/speeches/madridvii2003.ppt).

[4] Alliance of Automobile Manufacturers Comments at 7.

when making a left turn.[5] Our decision today to adopt a technical standard for all DSRC devices promotes a nationwide solution to the transportation safety challenges faced by all Americans.

4. The inefficiency of our surface transportation system also has costs on both the societal and individual level. According to one study, in 2000 the seventy-five largest metropolitan areas experienced 3.6 billion vehicle-hours of delay resulting in 5.7 billion gallons of wasted fuel, and $67.5 billion in lost productivity.[6] DSRC in the 5.9 GHz band will provide a critical link necessary for intelligent transportation systems to reduce these delays.

II. EXECUTIVE SUMMARY

5. In this *Report and Order*, we establish service rules to govern the licensing and use of the 5.850-5.925 GHz band (5.9 GHz band) for the Dedicated Short Range Communication Service (DSRCS) in the ITS[7] radio service. Specifically, in this *Report and Order*:

- We note that DOT envisions DSRC units in every new motor vehicle for life-saving communications. To ensure interoperability and robust safety/public safety[8] communications among these DSRC devices nationwide, we adopt the standard supported by most commenters and developed under an accredited standard setting process (ASTM E2213-03 or "ASTM-DSRC").

- We conclude that it is possible to license both public safety and non-public safety use of the 5.9 GHz band. Accordingly, we adopt open eligibility for licensing and technical rules, most of which are embodied in the ASTM-DSRC standard, aimed at creating a framework that ensures priority for public safety communications.

- We license DSRC Roadside Units (RSUs), communication units that are fixed along the roadside, under subpart M (Intelligent Transportation Radio Service) of Part 90 of the Commission's Rules. Licensees will receive non-exclusive geographic-area licenses authorizing operation on seventy megahertz of the 5.9 GHz band. We also adopt a framework whereby licensees would register RSUs by site and segment(s).

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[5] *See* ITS America Petition for Rulemaking, RM 9096, ET Docket No. 98-95 at 28-29 (filed May 19, 1997) (ITS America Allocation Petition). Other ITS safety applications envisioned to promote crash avoidance are road departure warning (*e.g.*, audible alarm: "Driver Alert! Vehicle is headed off the road.") and lane merge ("Unsafe to merge left/right!"). See Appendix C for a list of safety and other DSRC-based ITS applications.

[6] Federal Highway Administration, Congestion Mitigation at http://www.fhwa.dot.gov/congestion/congest2.htm.

[7] Section 6059 of the Intermodal Surface Transportation Efficiency Act of 1991, Pub. L. 102-240, 105 Stat. 1914 (1991) (ISTEA) defines ITS as:

> The development or application of electronics, communications, or information processing (including advanced traffic management systems, commercial vehicle operations, advanced traveler information systems, commercial and advanced vehicle control systems, advanced public transportation systems, satellite vehicle tracking systems, and advanced vehicle communications systems) used singly or in combination to improve the efficiency and safety of surface transportation systems.

ISTEA § 6059.

[8] We refer herein to "safety/public safety" communication interchangeably because DSRCS involves both safety of life communication transmitted from any vehicle, *e.g.*, vehicle-to-vehicle imminent crash warnings, as well as communication transmitted by public safety entities, *e.g.*, infrastructure-to-vehicle intersection collision warnings.

- We license On-Board Units (OBUs), in-vehicle communications units, by rule under new subpart L of Part 95 of our Rules.

III. BACKGROUND

A. Creation and Development of ITS

6. Congress created the ITS[9] program, a national program administered by the DOT in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).[10] Congress established goals for the ITS program that would incorporate technology and advanced electronics into the nation's surface transportation infrastructure to improve traveler safety, decrease traffic congestion, facilitate the reduction of air pollution, and conserve vital fossil fuels.[11] DOT selected the Intelligent Transportation Society of America (ITS America)[12] as its Federal Advisory Committee (FAC)[13] on ITS matters.[14]

7. In 1993, DOT, its partners, and ITS America began developing a national architecture[15] to implement ITS services.[16] Completed in 1996, and amended from time-to-time, the National

[9] Originally entitled "Intelligent Vehicle Highway Systems" ("IVHS"). *See* ISTEA.

[10] ISTEA § 6051.

[11] *See* ISTEA § 6052(b). Section 6053(b) of ISTEA states that:

> The Secretary shall develop and implement standards and protocols to promote the widespread use and evaluation of intelligent vehicle-highway systems technology as a component of the Nation's surface transportation systems. To the extent practicable, such standards and protocols shall promote compatibility among intelligent vehicle-highway systems technologies implemented throughout the States. In carrying out this subsection, the Secretary may use the services of such existing standards-setting organizations as the Secretary determines appropriate.

[12] ITS America, a Federal Advisory Committee to DOT, was first organized in 1991 and is a non-profit, educational association. Its members are drawn from the business, academic, and government sectors. ITS America has over 600 members. Over 350 of its members represent corporations involved in providing transportation of goods and services, 135 members represent federal, state, and municipal transportation agencies, and fifty members represent research institutions and universities. *See* Status Report on Licensing and Service Issues and Deployment Strategies for DSRC-Based Intelligent Transportation Services in the 5.850-5.925 GHz Band (filed by ITS America on Oct. 6, 2000) at 4-5 (Status Report). *See Ex Parte* Comments of the Intelligent Transportation Society of America: Status Report and Recommendations for Licensing and Service Rules for the DSRC Spectrum in the 5850-5925 MHz Band from Mark D. Johnson, counsel to ITS America, to Federal Communications Commission at 19 (filed July 9, 2002) (July *Ex Parte* Comments).

[13] *See* Federal Advisory Committee Act, P.L. 92-463, 86 Stat. 770 (1972) *codified at* 5 U.S.C. Appendix 2.

[14] Until March 17, 2003, DOT recognized ITS America as its FAC on ITS matters, including DSRC. DOT indicates that this change in status "does not suggest an intention on the part of DOT to revisit positions taken on technical standards and licensing and service rules proposed by ITS America. . . ." Letter from Paul Samuel Smith, Senior Attorney, United States Department of Transportation to Marlene H. Dortch, Federal Communications Commission at 1 (Apr. 29, 2003). Although, ITS America is no longer DOT's FAC on ITS matters, it is still required by TEA-21 to work with DOT to develop and update as necessary, the National ITS Program Plan. *See* Transportation Equity Act for the 21st Century, Pub. L. 105-178, 112 Stat. 107 § 5205(a)(1) (1998) (TEA-21).

[15] TEA-21 subsequently required the use of the National Architecture. Section 5206(a) of TEA-21 states:

> Consistent with section 12(d) of the National Technology and Advancement Act of 1995 . . ., the Secretary shall develop, implement, and maintain a national architecture and supporting standards

(continued....)

Architecture[17] currently identifies thirty-four ITS User Services,[18] which are divided into one or more of the eight User Service Bundles.[19] Recognizing the need to convey information between vehicles and roadside infrastructure in the development of ITS, the National Architecture identifies DSRC as critical for deploying many ITS User Services;[20] such uses are generally called DSRC-based ITS applications.[21]

8. In 1997, ITS America petitioned the Commission to allocate seventy-five megahertz of spectrum in the 5.9 GHz band for ITS, in particular for DSRC.[22] The following year, in 1998, Congress passed and the President signed into law the TEA-21,[23] which directed the Commission, in consultation with DOT, to consider the spectrum needs "for the operation of intelligent transportation systems, including spectrum for the dedicated short-range vehicle-to-wayside wireless standard,"[24] DSRC. TEA-21 also directed DOT to promote, through the National Architecture, interoperability among ITS technologies implemented throughout the United States.[25] In October 1999, the Commission allocated the

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> and protocols to promote the widespread use and evaluation of intelligent transportation system technology as a component of the surface transportation systems of the United States.

[16] U.S. Department of Transportation, Intelligent Transportation Systems, The National Architecture for ITS: A Framework for Integrated Transportation into the 21st Century (1996) at 2.

[17] The National Architecture establishes the types of information and communication that are needed to support various ITS services, how data should be shared and used by which physical entities, and the types of standards that are needed to facilitate sharing of information. ITS relies on the interaction among three "layers" of infrastructure, the transportation layer, the communications layer, and the institutional layer. The transportation layer is the physical ITS infrastructure composed of travelers, vehicles, and roadside equipment. The communications layer is the information infrastructure that connects elements of the transportation layer, thus allowing coordination and sharing among systems and people. The institutional layer is composed of organizations. *Id.* at 4.

[18] ITS America states that as "expected use of the band increases in the future, new and unforeseen applications will be deployed consistent with the ITS User Service Bundles." *See* July *Ex Parte* Comments at 24. Since the July *Ex Parte* Comments were filed, two new applications have been developed "Road Departure Prevention" and "Lange Merge Crash Avoidance." *See* Letter from Paul Samuel Smith, Senior Attorney, United States Department of Transportation to Marlene H. Dortch, Federal Communications Commission, Attachment (Nov. 4, 2003).

[19] July *Ex Parte* Comments at 24-25. The eight service bundles are listed in Appendix C.

[20] U.S. Department of Transportation, *Background: DSRC Allocation to Support Intelligent Transportation Systems* (Apr. 1997) at http://www.its.dot.gov/tcomm/dsrcbk.htm.

[21] *See* Status Report at 5-6.

[22] ITS America Allocation Petition at 1. DSRC is currently used for non-multilateration systems in the Location and Monitoring Service (LMS) in the 902-928 MHz band, primarily for electronic toll collection (ETC). Non-multilateration LMS systems use narrowband technology to transmit data to and from vehicles passing through a particular location. The LMS also includes multilateration systems. Multilateration LMS systems use spread spectrum technology to locate vehicles or other moving objects with great accuracy throughout a wide geographic area. *LMS Report and Order,* 10 FCC Rcd 4695, 4697 ¶ 4.

[23] *See supra* note 14.

[24] TEA-21 § 5206(f).

[25] Section 5206(a) of TEA-21 states:

> (2) Interoperability and efficiency.—To the maximum extent practicable, the national architecture shall promote interoperability among, and efficiency of, intelligent transportation system technologies implemented throughout the United States.

(continued....)

5.9 GHz band for DSRC-based ITS applications and adopted basic technical rules for DSRC operations. The Government's Radiolocation Service (*i.e.*, for use by high-powered military radar systems) and non-Government Fixed Satellite Service (FSS) uplink operations are co-primary in the 5.9 GHz band.[26] Additionally, Amateur Radio Services have a secondary allocation in the 5.9 GHz band and Industrial, Scientific and Medical (ISM) devices may operate in the 5.85-5.875 GHz portion.

9. Subsequent to the Commission's allocation of the 5.9 GHz band to the mobile service for use by DSRC systems, ITS America, as the FAC to DOT, began to hold stakeholder workshops, panel discussions, and other industry meetings to develop a consensus on how to achieve national interoperability in the deployment of DSRC-based ITS user services.[27] The Federal Highway Administration (FHWA), an agency of DOT, entered into a cooperative agreement[28] with the American Society for Testing and Materials (ASTM) [29] to develop a national, interoperable standard for DSRC equipment operating in the 5.9 GHz band. On October 6, 2000, ITS America filed a Status Report with the Commission, which addressed licensing and service rules and deployment strategies for DSRC. On March 22, 2001, the Wireless Telecommunications Bureau (Bureau) sought comment on the Status Report.[30] On May 10, 2002, the ASTM Subcommittee E17.51[31] selected the ASTM-DSRC Standard, which uses Orthogonal Frequency Division Multiplexing (OFDM), as the standard for DSRC-based ITS applications in the 5.9 GHz band.[32]

B. Notice of Proposed Rulemaking

10. On November 7, 2002, we adopted a *Notice of Proposed Rule Making* (*NPRM*) regarding the service rules for the DSRCS in the 5.9 GHz band.[33] Generally, the *NPRM* sought comment on

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> (3) Use of standards development organizations.—In carrying out this section, the Secretary may use the services of such standards development organizations as the Secretary determines to be appropriate.

[26] *See* 47 C.F.R. § 2.106, Table of Frequency Allocations.

[27] Status Report at ii.

[28] *See* Transportation Equity Act for the 21st Century; Critical Intelligent Transportation Standards, *Notice*, 66 Fed. Reg. 20517 (Apr. 23, 2001), where the FHWA states that, in response to the requirements of TEA-21, it entered into cooperative agreements with five Standards Development Organizations (SDOs), including ASTM, to accelerate the development of ITS standards that would promote national interoperability. FHWA further states that the standards developed under this program are "consensus standards and will remain the property of the SDO under which they were developed." *See also* Status Report at 11-12.

[29] According to ITS America, ASTM is a participating member of the American National Standards Institute (ANSI). *See* July *Ex Parte* Comments at 13.

[30] Wireless Telecommunications Bureau Seeks Comment Regarding Intelligent Transportation System Applications Using Dedicated Short Range Communications, *Public Notice*, DA 01-686 (WTB PSPWD rel. Mar. 16, 2001) (corrected Mar. 22, 2001) (*Bureau Public Notice).*

[31] See Appendix E for a list of the Standards Writing Group participants.

[32] ASTM, Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Designation: E 2213-03 (published September 2003) (ASTM-DSRC Standard). *See* July *Ex Parte* Comments at 1-2, 13.

[33] *Notice of Proposed Rule Making and Order*, 17 FCC Rcd 23136 (2002) (*NPRM*).

licensing and service rules proposed by DOT and ITS America.[34] Specifically, ITS America recommended that we incorporate into our rules the ASTM-DSRC Standard, which includes a band plan and technical rules; permit both public safety and non-public safety DSRC-based ITS applications in the 5.9 GHz band; license the roadside units, the fixed or portable DSRC transceiver by site; require frequency coordination using the Part 90 model; license the on-board units, the mobile transceivers generally mounted in motor vehicles, by rule; and amend the definition of DSRC service to permit a voice interface to warn drivers of hazardous conditions and to prohibit Commercial Mobile Radio Services (CMRS) or CMRS-like services in the band. We received thirty-five comments and thirteen reply comments in response to the *NPRM*. Subsequently, on June 10, 2003, the Standards Writing Group,[35] an ASTM working group, approved the ASTM-DSRC Standard for DSRC operations.[36]

IV. DISCUSSION

A. Technical Rules for Interoperability and Protection of Public Safety Communications

1. Necessity of a Standard for DSRC

11. *Background.* In the *NPRM*, we noted that TEA-21 requires the Secretary of DOT to promote "interoperability" among ITS technologies implemented throughout the United States and it appears to contemplate the adoption of a wireless standard as a means of achieving this "interoperability."[37] We sought comment on the meaning of "interoperability" within the context of the DSRCS. Specifically, we invited comment on whether public safety DSRC-based ITS applications should be interoperable or whether both public safety and non-public safety DSRC-based ITS applications should be interoperable.[38] Further, we requested comment on whether adopting a technical standard would promote interoperability and, if so, whether to adopt Layers 1, the Physical Layer, and 2, the Medium Access Control Layer, of the ASTM-DSRC Standard, which the ASTM and the Institute of Electrical and Electronic Engineers (IEEE) developed as the means of achieving interoperability.[39]

12. All commenters, except QUALCOMM,[40] urge us to adopt a standard citing the current lack of interoperability among DSRC operations in the 900 MHz band, wherein there is no standard, and the critical need for 5.9 GHz band DSRC units to be interoperable nationwide. QUALCOMM recommends that the focus, at this juncture, should be on developing higher layer application interoperability specifications rather than lower-level interoperability, which it indicates can be achieved in a number of different ways, such as through the use of multi-mode devices.[41] However, DOT states that "historical experience is . . . instructive"[42] because electronic toll collection (ETC) in the 902-928

[34] July *Ex Parte* Comments (filed in response to the Bureau Public Notice). *See also* note 14, *supra* (DOT does not intend to revisit ITS America's technical and licensing proposals).

[35] The Standards Writing Group was formed by ASTM in June 1999 to develop user requirements for DSRC and to draft open and interoperable standards. *See* July *Ex Parte* Comments at 12-14.

[36] ASTM-DSRC Standard at 1(approved July 10, 2003).

[37] *See NPRM,* 17 FCC Rcd at 23142-43, 23157 ¶¶ 7, 31.

[38] *Id.* at 23158 ¶ 33.

[39] *Id.* at 23155 ¶ 28.

[40] QUALCOMM Reply Comments at 8 (urges neutrality and leaving the selection of technology to licensees).

[41] QUALCOMM Reply Comments at 3-4.

[42] DOT Comments at 3.